

Move It Exactly

Draw rigid transformations and justify a mapping sequence.

HIGH SCHOOL • HSG-CO.A.5

CCSS.Math.Content.HSG-CO.A.5 "Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software..."

NAME _____

DATE _____

Materials and setup

Use a pencil and ruler with these grids; tracing paper or geometry software may help. Label each image PQR and connect its vertices; the challenge also uses UVW for a second image. Keep ABC visible. Solid outlines are originals; dashed outlines on supplied comparisons and the key are images.

A RULE MUST MOVE EVERY POINT

A rigid transformation preserves lengths and angles. Translation adds the same vector to every point.

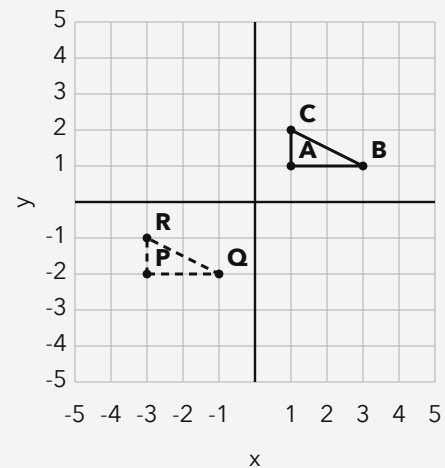
Reflection places each point the same perpendicular distance across its mirror line. Rotation turns every point through the same angle about the stated center. A sequence must carry the entire figure onto its target.

WORKED EXAMPLE

Translate ABC left 4 units and down 3 units. The dashed image is PQR. Explain how each image vertex was found.

1. Apply $(x,y) \rightarrow (x-4,y-3)$ to each vertex.
2. $A(1,1) \rightarrow P(-3,-2)$; $B(3,1) \rightarrow Q(-1,-2)$; $C(1,2) \rightarrow R(-3,-1)$.
3. Connect P, Q and R. Corresponding sides remain parallel and the same length.

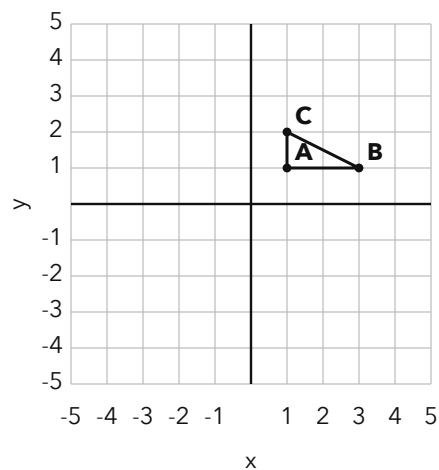
Answer: The dashed triangle is the translated image of every point of ABC.



PRACTICE 4 problems

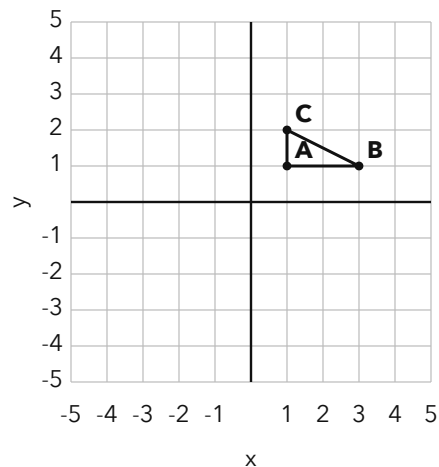
- 1** Draw the image of ABC after a translation left 3 and up 2.

ANSWER _____



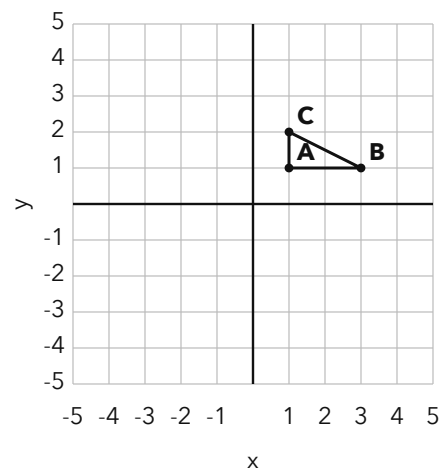
- 2** Draw the image of ABC after reflection across the y-axis.

ANSWER _____



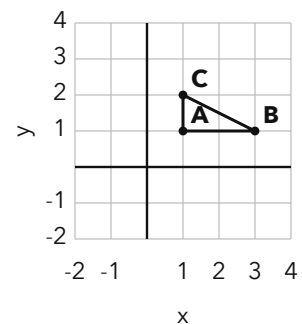
- 3** Draw the image of ABC after a 90° counterclockwise rotation about the origin.

ANSWER _____



- 4** Draw the image of ABC after a 90° clockwise rotation about A(1,1). A stays fixed. Show how you located Q.

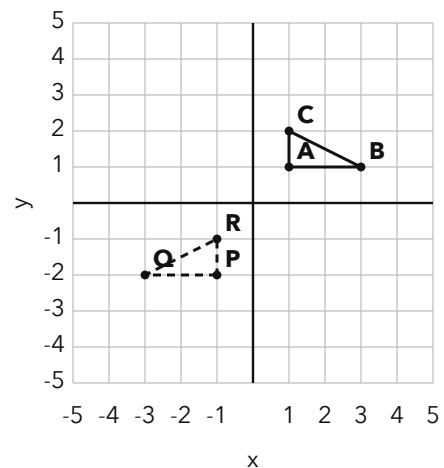
ANSWER _____



APPLY IT Show your work

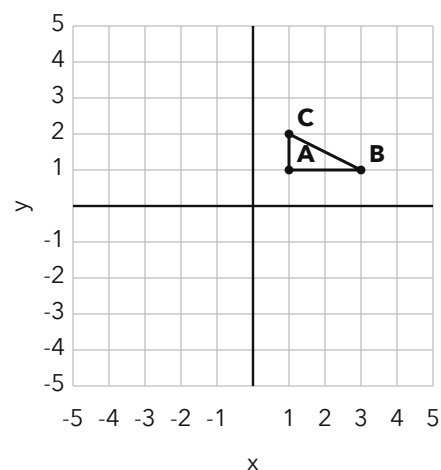
- A map icon changes from solid ABC to dashed PQR.
- 1** Specify a sequence using a reflection and a translation. Verify it at every vertex.

ANSWER _____



- 2** A tile design rotates ABC 180° about the origin, then translates up 4 units. Draw the final PQR and record the intermediate vertices.

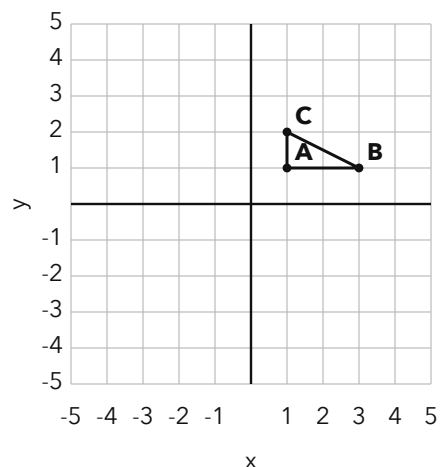
ANSWER _____



CHALLENGE One step up

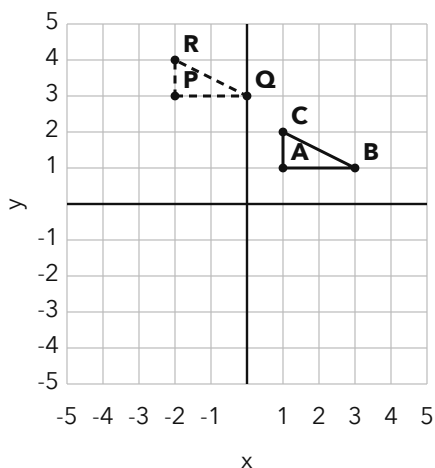
Start with ABC . Compare “reflect across the y -axis, then translate right 1” with the reverse order. Draw both resulting triangles on this grid, labeling the first image PQR and the reverse-order image UVW . Do they coincide? Explain using A .

WORK SPACE AND ANSWER



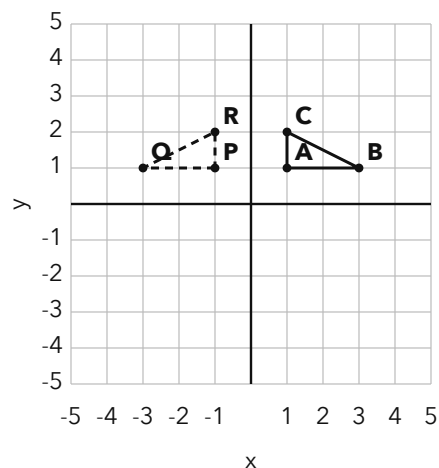
PRACTICE 1

$P(-2,3)$, $Q(0,3)$, $R(-2,4)$. Require the connected, labeled triangle.



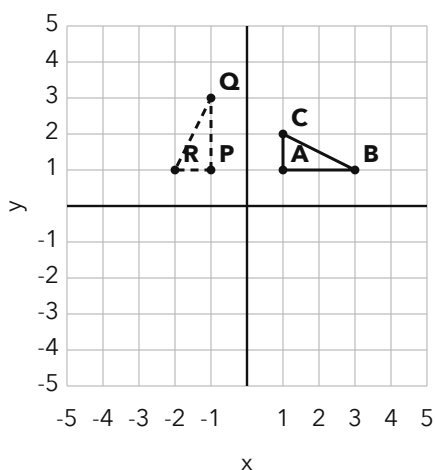
PRACTICE 2

$P(-1,1)$, $Q(-3,1)$, $R(-1,2)$. Require the connected, labeled triangle.



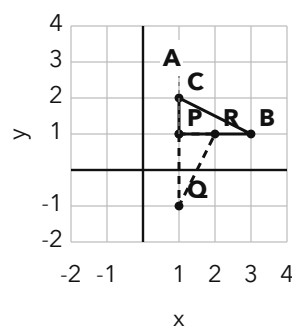
PRACTICE 3

$P(-1,1)$, $Q(-1,3)$, $R(-2,1)$. Require the connected, labeled triangle.



PRACTICE 4

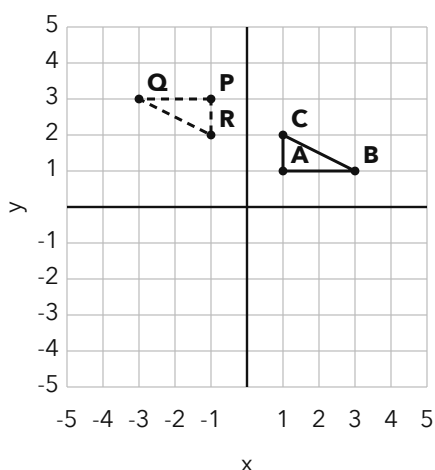
$P(1,1)$, $Q(1,-1)$, $R(2,1)$. Require the connected, labeled triangle.



APPLY IT 2

$P(-1,3)$, $Q(-3,3)$, $R(-1,2)$. Require the connected, labeled triangle.

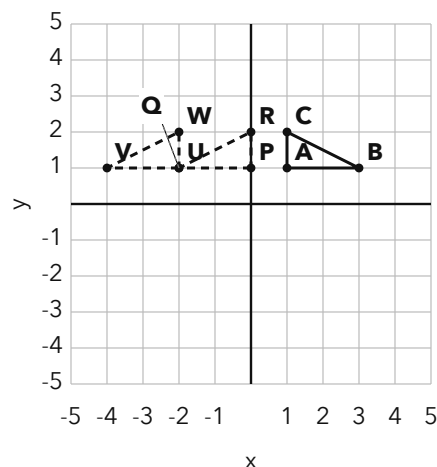
Intermediate vertices: $(-1,-1)$, $(-3,-1)$, $(-1,-2)$. After translation: $(-1,3)$, $(-3,3)$, $(-1,2)$.



CHALLENGE

No. Reflection then translation sends A to $(0,1)$, B to $(-2,1)$, C to $(0,2)$. Translation then reflection sends A to $(-2,1)$, B to $(-4,1)$, C to $(-2,2)$. Reversing the order shifts the whole image left 2 units.

Check actual drawings in all four practice tasks, Apply It 2 and the challenge. Coordinate lists alone do not meet the drawing requirement. Accept clearly distinguished outlines and equivalent labeling; in the challenge the key names the first image PQR and the reverse-order image UVW. Any verified mapping sequence in Apply It 1 is acceptable. For Practice 4, rotate offsets from A: $B-A=(2,0) \rightarrow (0,-2)$, giving $Q(1,-1)$.



APPLY IT 1

Reflect across the y-axis, then translate down 3: $P(-1,-2)$, $Q(-3,-2)$, $R(-1,-1)$.

Reflection gives $(-1,1)$, $(-3,1)$, $(-1,2)$; subtracting 3 from every y-value produces the target.